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VIII. *An improved Method of tanning Leather.* By David Macbride, M. D. *communicated by Sir John Pringle, Bart. P. R. S.*

SIR,

Dublin,
May 30, 1777.

Read Jan. 22,
1778.

A GREEABLY to the promise which I made you some years ago, I now send you my secret method for the more expeditious tanning of leather. If you think the letter, and paper which it incloses, worthy of the Society's attention, you will please to present them. I have already delivered in one of these sets of instructions to our Dublin Society (who have been acquainted with the whole progress of this affair since the beginning) and have sent two others to the Societies which are established in London and Edinburgh, for the purpose of encouraging trade and manufactures; as judging it will be more in their way than in the Royal Society's to extend the utility of this invention: for I apprehend it will require some encouragement from
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them, in the way of premium, to set the business a-going, so strong are the prejudices amongst tradesmen of all sorts against trying new practices, and such the reluctance with which they quit their ancient ways of working.

I am, &c.

SIR,

Dublin,
May 31, 1777.

YOU may please to remember that I informed you, some years ago, of my having found out a way of tanning leather in less time, and at a smaller expence of materials, than can be done by any of the ways hitherto known or practised; and promised that, as soon as I should find myself at liberty to disclose it, I would communicate my method to the Royal Society.

Accordingly I take the liberty of inclosing a set of instructions, which I drew up for the person who conducted the business of a large tan-yard belonging to a company with which I have had an engagement for these last four years; which I apprehend will be found
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sufficiently clear for enabling any intelligent tanner to avail himself of my improvements.

I beg you will present this paper to the Society; but, as it cannot be understood by gentlemen who are not already, in some degree, acquainted with the ordinary process of tanning, I must request their indulgence while I mention the principal operations in this branch of manufacture.

The use of tanning is two-fold; first, to preserve the leather from rotting; and, secondly, to render it impervious to water.

An infusion of any strongly-astringent vegetable will serve to tan leather, so far as to prevent its rotting; but if this vegetable does not contain a good deal of gum-resin, it will not answer for enabling it to keep out water: and hence it is that oak-bark, which is more abundant in the gummy-resinous part than any of our common indigenous astringents, is preferred to all other substances for the purpose of tanning.

The tanners prepare their bark by gently drying it on a kiln, and grinding it into a very coarse powder. They then either use it in the way of infusion, which is called ooze; or they strew the dry powder between the layers

of hides and skins, when these are laid away in the tan-pits.

The ooze is made by macerating the bark in common water, in a particular set of holes or pits, which, to distinguish them from the other holes in the tan-yard, are termed latches.

The first operation of the tanner is to cleanse his hides from all extraneous filth, and remove any remains of flesh or fat which may have been left behind by the butcher.

The hair is next to be taken off, and this is accomplished either by steeping the hides for a short time in a mixture of lime and water, which is termed liming; or by rolling them up close, and piling them in heaps, where they quickly begin to heat and putrify. The hair being loosened is scraped off, and the tanner proceeds to the operation called fleshing, which consists in a further scraping, with a particular kind of knife contrived for the purpose, and cutting away the jagged extremities and offal parts, such as the ears and nostrils.

The raw leather is then put into an alkaline ley, in order to discharge the oil, and render its pores more capable of imbibing the ooze. The tanners of this country generally make their ley of pigeon's dung; but
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a more active one may be prepared from kelp or pot-ash, taking care, however, not to make it too strong of the ashes, nor to allow the leather to remain too long in the ley.

The oil being sufficiently discharged, the leather is ready for the ooze, and at first is thrown into smaller holes, which are termed handlers; because the hides or skins, during this part of the process, are taken up, from time to time, and allowed to drain; they continue to work the leather in these handlers, every now and then stirring it up with the utensil called a plunger, which is nothing more than a pole with a knob at the end of it, until they think proper to lay it away in the vatts. In these holes, which are the largest in the tan-yard, the leather is spread out smooth, whereas they toss it into the handlers at random, and between each layer of leather they sprinkle on some powdered bark, until the pit is filled by the leather and bark thus laid in *stratum super stratum*: ooze is then poured on, to fill up interstices; and the whole crowned with a sprinkling of bark, which the tanners call a heading.

In this manner the leather is allowed to macerate, until the tanner sees that it is completely penetrated by the ooze: when this is accomplished (which he knows by

cutting out a bit of the thickest part of the hide) the manufacture is finished, so far as relates to tanning, since nothing now remains but to dry the goods thoroughly, by hanging them up in airy lofts built for the purpose. Such in general is the process for tanning calf-skins, and those lighter sorts of hides which are called butts; but the large, thick, heavy hides, of which the strongest and most durable kind of soal-leather is made, require to have their pores more thoroughly opened before the ooze can sufficiently penetrate them. For this purpose, while the hides are in the putrescent state, from being allowed to heat in the manner already mentioned, and well soaked in an alkaline ley, they are thrown into a sour liquor, generally brewed from rye, in order that the effervescence which necessarily ensues may open the pores.

The tanners term this operation raising, as the leather is considerably swelled, in consequence of the conflict between the acid and alkali. This is an English invention; for it appears from M. DE LA LANDE, who was employed by the Royal Academy of Sciences to write on the art of tanning, that the foreign tanners know nothing of this branch of the business: indeed, their whole process, according to his account, is slovenly,
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and even more tedious than our common method, and must make but very indifferent leather.

When the raising is accomplished, the leather is put into the handlers, and worked in them for the requisite time; then laid away in the vatts, and there left to mace-rate until the tanning is found to be completely finished, which, for the heaviest kind of leather, such as this of which I am now speaking, requires from first to last full two years. At least, the tanners of this country cannot make foal-leather in less time; what they are able to perform in England, I am not so thoroughly acquainted with.

It is this tediousness of the process which enhances the value of leather; and the returns being so slow, the trade of tanning never can be carried on to advantage, but by persons possessed of a large capital; therefore, one sure way of increasing the number of tanners, and of course of bringing down the price of their manufacture, is to shorten the process; and if at the same time we can improve the quality of the leather, and save somewhat in the expence of tanning materials, the public will be essentially benefited in respect to one of the necessary articles of life.

All this, I will venture to say, can be done by pursuing the method which is laid down in the inclosed paper, and which may be introduced into any common tan-yard.

With respect to time it is possible, in the way that I have found out, to finish leather in a fourth part of what is required in the ordinary process; for I have repeatedly had calf-skins tanned in a fortnight or four weeks, which in the common way could not be done in less than from two to four months.

I shall not pretend, however, to affirm, that that business can be carried on in the large way with such expedition; because a great deal of this abridgement of time was probably owing to frequent handling and working of the leather; but I am confident, and know it from four years experience, that in the ordinary course of business, and in a common tan-yard, the tanner may save at least four months out of twelve, produce better leather, and find his bark go much farther than in the old way of tanning.

Having premised thus much, I flatter myself that the paper of instructions will be found perfectly intelligible. It shews, that the principles on which my method is established are derived from chemistry, and therefore it will
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not appear strange, that these improvements should have been made by a person of the medical profession : indeed, they took their rise from a series of experiments carried on purely for medical purposes (the very same that confirmed me in the opinion that infusion of malt would cure the sea scurvy) and any person who will look into the account of those experiments, will readily understand the theory of the new method of tanning^(a).

It would be trespassing on the time of the Society, to enter into any detail of the circumstances that first induced me to think of this matter, or to give a history of the progress of my experiments, which at first were made at home, and with little pieces of raw leather : it is sufficient to say, that the efficacy of this method has been fully proved by the experience of near ten years (during which I have thought proper to keep it secret) and I now bestow it to the public.

I am, &c.

(a) See the Essay on the dissolvent Power of Quicksilver, among the Experimental Essays on Medical and Philosophical Subjects.

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Instructions to Tanners, for carrying on the new method of tanning, invented by Dr. MACBRIDE of Dublin; whereby the leather is not only improved in its quality, but tanned in much less time, and with a smaller quantity of bark, than in any other method hitherto known or practised.

AS the new method of tanning depends on this principle, "That lime-water extracts the virtues of oak-bark more completely than plain water;" the first thing in which the tanner is to be instructed, is the making of lime-water.

I. Provide a large vessel, in the nature of a cistern, whose depth shall be at least twice its diameter, and of a capacity adapted to the extent of the tan-yard.

II. This cistern must be fixed in a convenient corner of the yard, under a shed, and should stand so as that the liquor which is to be drawn off from it may run freely into the latches.

III. There must be a cock fixed in the side of the cistern, about a foot from the bottom, to let off the contents; and there must be a hole in the bottom of it, of
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five or six inches diameter, which is to be stopped with a plug. Let this hole open over a gutter.

IV. The cistern must be covered with a flooring of boards, strong enough to bear a man's weight; and from side to side of this lid there must be an opening of two or three feet wide.

V. If it can be so contrived that a water-pipe may be led into the cistern, it will save the servants a good deal of trouble; but if this cannot be done, a pump must be fixed in the most convenient way, for the purpose of filling it from time to time.

VI. The cistern being once fixed (which is all the additional apparatus that the new method of tanning requires) the making of lime-water will be found extremely simple and easy.

VII. You are first to fill the cistern with water, and then, for every hogshhead that it may contain, throw in ten or a dozen pounds weight of unslaked lime.

VIII. Mix the lime thoroughly with the whole body of the water, by stirring it exceedingly well from the bottom, with a bucket and plunger, until you perceive that the lime is completely diffused, and the whole mixture grows as white as milk; leave it then to settle for a couple of days, that the undissolved part of the lime may

entirely subside, and the water become perfectly limpid, and clear as rock-water. Your lime-water will then be fit for immediate use.

ix. The cock, as already mentioned, is to be fixed at least twelve inches from the bottom of the cistern, in order that only the limpid part of the lime-water may run off; and the use of the hole in the bottom, which is ordered to be stopped with a plug, is to let off the gross and insoluble remains of the lime, as often as it may be found necessary to clean out the cistern.

x. When the first brewing (as it may be termed) of lime-water is all expended, you are to fill up the cistern with water a second time; stir up the lime from the bottom with the bucket and plunger, so as to mix it thoroughly with the whole body of the water, as before directed, and then leave it to subside for the requisite time. Thus you will have a second brewing of lime-water; and you may go on in the same manner to make a third, fourth, fifth, or perhaps a sixth, or more brewings, from the original quantity of lime; provided you shall find the lime-water continue sufficiently strong.

xi. There are two ways of knowing when lime-water is sufficiently strong. The one is by the taste, and this a little practice will teach you to distinguish; the other is,
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by observing a certain solid scum, like the flakes of very thin ice, which collects and forms itself on the surface of the lime-water.—As long as you find this solid scum floating on the top of the water in the cistern, so long you may conclude that there is no necessity for throwing in fresh lime.

XII. But when the scum ceases to appear, or you find from the taste that the lime-water is not so strong as it ought to be, you must then take out the plug from the bottom of the cistern, and clear it by sweeping away the gross remains of lime: and after you have cleaned the cistern, begin your brewings of lime-water a-new, and proceed in the manner already directed, as to stirring up the lime, and leaving it to settle for the necessary time, so as to have your lime-water perfectly limpid. In this manner you may go on from year to year, and constantly keep yourself in stock with respect to lime-water.

XIII. It is this lime-water which is now to be used in making your ooze instead of the plain common water; and this is all the difference between the old and the new method of tanning; for when your ooze is prepared, by steeping your bark in lime-water (in the latches, as you do at present, only running it through two latches) you are to make use of it in the very same

way that you have hitherto used the common ooze, there not being the least variation required with respect to any of the previous management before the skins or hides are fitted for the ooze. Every thing that relates to cleaning, liming, fleshing, &c. is to be conducted precisely as in the old or common method of tanning; and the goods are to be worked in the handlers for the requisite time, and then laid away in the vatts, with layers and heading of bark, just as you now practise; and when you observe that the leather is sufficiently penetrated with the ooze, that is to say, completely tanned, you will take it up, dry it, and afterwards dress it according to the different uses for which it is intended. You are always to observe, however, that the ooze is to be turned from one leech on another before it is used, otherwise it will be apt to blacken the leather.

xiv. What has been hitherto said relates only to butts and calf-skins: as to foal-leather, which is prepared for the ooze by steeping it in some four liquor, in order to open its pores, and raise it (according to the tanner's phrase) the new method requires a different practice from the old one.

xv. In the old method, the tanners made use of fourings brewed generally from rye, or some other grain;

but these liquors are not only troublesome to brew and to ferment, but they are always uncertain as to their degree of sourness or strength, which depends on the state of the weather, and other variable circumstances; these liquors are moreover exceedingly apt to rot the leather, and, without great care, may injure it very materially in its texture.

xvi. To obviate these inconveniences, you are to imitate the bleachers of linen, who make use of a sour prepared by diluting the strong spirit of vitriol (vulgarly, but improperly, termed oil of vitriol) with a sufficient quantity of plain water.

xvii. It was not without much difficulty that the bleachers could be prevailed on to quit their old sourings, made either like yours of rye or barley, or of sour butter-milk, from a groundless fear, that the vitriolic souring would corrode their cloth; but the experience of many years has convinced them of their error, and now no other souring is used. In like manner the tanners at first may some of them be afraid to use the vitriol, but a little practice will shew how far superior this souring is to what they have hitherto used. They will never find it subject to any change in respect to strength from variations of weather, or different degrees of heat; and
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so far from tending to rot the leather, it gives unusual firmness; and the soals which are raised by the vitriolic fouring are remarkably sound, and always free from the slightest degree of rottenness. Besides, the same four may do for many parcels of leather, by adding a little vitriol to it; and it need only be thrown away, when it becomes too dirty for use, by the frequent succession of hides.

XVIII. A wine pint of the strong spirit of vitriol, which will not cost more than nine or ten pence^(a), is sufficient for fifty gallons of water to prepare the fouring at first: therefore all you have to do, in raising the soals, is only to prepare them before-hand in the usual way; and, when they are fitted for the fouring, mix up a quantity of vitriol and water, according to the number of hides that you require to have raised, still observing the proportion of a pint to fifty gallons, which will be enough, if the vitriol be of the due degree of strength. The hides may lie in the fouring till you find them sufficiently raised, for they will be in no danger of rotting, as they would be in the common corn fourings, which in time might turn putrid, and rot the leather; whereas, the vitriolic fouring keeps off putrefaction.

(a) The oil of vitriol is sold by the druggists in large bottles, containing eight or ten gallons.

XIX. When

xix. When you find your hides sufficiently raised, put them directly into the ooze, and go on with the tanning as in the old way; and you will see that the lime-water ooze penetrates raised leather even faster than it does butts or calf-skins, allowance being made for their different degrees of thickness.

xx. Let it be now supposed that you have your cistern fixed, your lime-water prepared, and some latches full of lime-water ooze, which has been run through two latches in order that the lime-water may completely spend its force on the bark; you are not to throw away what common ooze you have in stock in the yard, but only as it shall be spent; then, indeed, you are to throw it away, and supply its place with the lime-water ooze.

xxi. In a very few days you will perceive the difference between the activity of the two oozes, the new and old, with respect to penetrating the leather; and thus, without any kind of loss or waste, you will get rid of all your old liquors, and come speedily into a full stock of the ooze made with lime-water; and after you have got the new method established, your business will go in a regular course, and one parcel of goods will succeed another, as fast as you can manufacture and dispose of them.

xxii. Though it is possible to tan small parcels of leather, by way of experiment, by the use of lime-water ooze,

ooze, in a fourth part of the time which is required, if only common ooze be made use of; yet the business of a large tan-yard cannot be carried on with so much expedition: but even in large works, and in the common course of business, foal leather can be completely tanned and finished, in, from eleven to fifteen months, according to the different weight and thickness of the hides. Butts in, from eight to twelve months, and calf-skins in, from six to twelve weeks; in general, the tanner may save at least a third of the time that has hitherto been required.

xxiii. The leather, which is manufactured in the new way, is of a superior quality to that of the old tannage, especially the foal-leather, which wears remarkably well, and never shews the least sign of rottenness.

xxiv. Let it always be remembered, that the lime-water is never to be used but when it is sufficiently strong, and as clear as rock-water.

xxv. Whenever you make fresh ooze, you must always use fresh lime-water, and run the ooze through two latches; and the lime-water ooze, when spent, from lying on the leather, is never to be returned back upon the bark which is in the latches (as you now return your spent ooze) but must always be thrown away, as being
entirely

entirely useless; for which purpose you must contrive a gutter in the tan-yard to carry off the spent ooze.

xxvi. The latches ought to be under cover, lest the rain get into them and weaken the ooze, and if the handlers are sheltered, it will be so much the better; but it is of no importance to cover the vatts, provided, when the leather is laid away in them, they are kept constantly full to the brim.

xxvii. You must always take care to have a sufficient stock of unslaked lime by you (for if it be slaked, it will not answer to make lime-water): therefore, get your lime fresh, if possible, from the kiln, and immediately pack it in any kind of old dry casks. Weigh one of these casks, and it will enable you to ascertain the quantity of lime necessary to be thrown into the cistern each time you begin a fresh brewing of your lime-water, and thus save you the trouble of repeated weighings; not that there need be much nicety about the quantity of lime, a score of pounds over or under making no sensible difference in the strength of the lime-water.

xxviii. Any expence you may be at in procuring lime, which even in the largest tan-yards can amount but to a trifle, will be amply compensated by the saving of bark; because, that lime-water so completely exhausts

the bark, and makes it go so much farther than when the ooze is made only of plain water. As a proof of this, you may make a pretty strong ooze from the tan or spent bark, which you now consider as completely exhausted, by infusing in it lime-water.

Tanners, as they become acquainted with the new method, will find it perfectly easy, and may no doubt make further improvements by experience. The foregoing directions were found sufficiently full for enabling a gentleman at Belfast to carry on the business in an extensive way for these four years past; and it is presumed they will prove equally clear and intelligible to all other persons in the tanning trade.

Dublin, May the 1st, 1777.

